

**TAENIOGONALOS RAYMENTI CARMEAN & KIMSEY
(HYMENOPTERA: TRIGONALIDAE) REARED AS A
HYPERPARASITE OF *STURMIA CONVERGENS*
(WEIDEMANN) (DIPTERA: TACHINIDAE), A PRIMARY
PARASITE OF *DANAUS PLEXIPPUS*
(L.) (LEPIDOPTERA: NYMPHALIDAE)**

ANTHONY R. CLARKE¹ AND MYRON P. ZALUCKI

Department of Zoology and Entomology, The University of Queensland,
Queensland, 4079, Australia

Abstract.—*Taeniogonalos raymenti* is confirmed as a hyperparasitoid of the tachinid *Sturmia convergens* which parasitises larval *Danaus plexippus*. Trigonalids are indirect parasitoids and in this case we have direct evidence that wasp eggs must have been laid on the caterpillar's host plant, *Asclepias fruticosa*, before the secondary host, but not necessarily before the primary tachinid host, was present. Levels of hyperparasitism during our sampling period were very low at less than two percent.

Key Words.—Insecta, *Sturmia*, Tachinidae, *Asclepias*.

Trigonalid wasps are unique among the parasitic Hymenoptera as they oviposit onto foliage and the eggs are subsequently injected, along with the foliage, by larval sawflies or herbivorous caterpillars. The host relationships of larval trigonalids are poorly known, but most appear to be either primary parasitoids of larval sawflies, or hyperparasitoids of hymenopteran and tachinid parasitoids (Weinstein & Austin 1991). The family has a cosmopolitan distribution, but is quite small with only 100 known species. The biology, host relationships and systematics of trigonalids are reviewed by Weinstein & Austin (1991) and Carmean & Kimsey (1998). One of the major messages in both those reviews is that trigonalids remain a very poorly known group, with little or no biological information for most species. This note supplies a new host record for a trigonalid species from South-east Queensland.

MATERIALS AND METHODS

Collection and Rearing.—As part of wider study, 222 wild, 5th instar *Danaus plexippus* (L.) caterpillars were collected from four sites in South-east Queensland from February to November 1998. Collections were made at Mt Crosby (27°32' S, 152°49' E), The University of Queensland Veterinary Research Farm Pinjarra Hills (= Moggill Farm) (27°35' S, 152°53' E), Dunn's Creek via Beenleigh (27°43' S, 153°09' E) and Pine River via Boondal (27°17' S, 152°55' E).

Caterpillars were collected from either *Asclepias fruticosa* L. or *A. curassavica* L., returned to the laboratory and reared individually on cut foliage of the host species they were collected on until they pupated. A further 33 caterpillars were obtained by placing *D. plexippus* eggs onto *A. fruticosa* plants, which did not carry existing *D. plexippus* eggs or larvae, at Moggill Farm and then immediately

¹ Current Address: Australian School of Environmental Studies, Griffith University Nathan Campus, Qld, 4111.

Table 1. Fate of fifth instar *Danaus plexippus* (L.) larvae collected from sites in South-east Queensland. (*P.l.* = *Paradrino laevicula* Mesnil, *S.c.* = *Sturmia convergens* (Weidemann), *W.s.* = *Winthemia sumatrana* (Townsend).

Collection site	Date	No. of larvae collected	No. of larvae parasitised	No. of adult tachinids emerging (<i>P.l./S.c./W.s.</i>)	No. of trigonalids reared
<i>Wild collections</i>					
Mt Crosby	Feb 98	21	18	31 (25/1/5)	0
Dunn's Ck	Apr 98	31	18	25 (21/4/0)	0
Pine River	May 98	27	12	19 (16/3/0)	0
Pine River	June 98	6	3	0	0
Dunn's Ck	June 98	22	19	36 (32/4/0)	0
Dunn's Ck	June 98	21	15	21 (21/0/0)	0
Dunn's Ck	June 98	40	20	24 (22/1/1)	0
Dunn's Ck	Nov 98	23	22	30 (17/13/0)	0
Moggill Farm	Nov 98	21	19	40 (10/26/4)	1
Mt Crosby	Nov 98	10	5	11 (6/5/0)	0
<i>"Bag" reared</i>					
Moggill Farm	Nov 98	33	33	48 (0/48/0)	6

bagging the plants with insect proof gauze. Caterpillars were harvested as 5th instars and then reared as above.

Identification and Voucher Material.—Trigonalids were identified by J. C. Cardale, Australian National Insect Collection, CSIRO Entomology, Canberra. Voucher material has been deposited with the University of Queensland Insect Collection. Tachinids were identified by B. Cantrell, Queensland Department of Primary Industries, Brisbane. Two species of tachinid were routinely reared from monarch butterfly caterpillars during our research. We were able to determine which tachinid was the trigonalid host from the remnant pupal cases, which are noticeably different between the two tachinid species.

RESULTS

Danaus plexippus caterpillars were found to be heavily parasitised by tachinids, most commonly *Sturmia convergens* (Weidemann) and *Paradrino laevicula* Mesnil. Both have been previously recorded as primary parasites of *D. plexippus* in South-east Queensland (Zalucki 1981). As we will be reporting on primary parasitism elsewhere, we will not here discuss it further.

Seven trigonalid wasps emerged from seven tachinid pupal cases which had emerged from seven individual caterpillars. These were identified as individuals of *Taeniogonalos raymenti* Carmean & Kimsey (previously *T. tricolor* Rayment, see Carmean & Kimsey 1998). All but one of these specimens were reared from a single collection of caterpillars made from plants which had been bagged immediately after placing butterfly eggs upon them (Table 1). In all cases the tachinid host, based on pupal case identification, was *S. convergens*. Because plants had been bagged immediately following artificial butterfly egg placement, it confirms that both *S. convergens* and *T. tricolor* placed their eggs on the host plant (*A. fruticosa*) prior to the presence of the primary host insect. The identity of the tachinid from which the seventh wasp was reared was not recorded, but the host plant was again *A. fruticosa*.

Overall hyperparasitism rate was only 1.8% ($n = 397$ tachinids reared), but for the case where 6 wasps were reared from a single collection, the hyperparasitism rate was 13% ($n = 46$ tachinids reared).

DISCUSSION

Taeniogonalos is the most widely distributed genus of the Trigonalidae and species in the genus have been reared previously as primary parasitoids of sawflies, or a hyperparasitoids of tachinid and ichneumonid parasitoids of lepidoptera (Carmean & Kimsey 1998). This is the first rearing and oviposition substrate record for *T. raymenti*, but it is not the first time the genus *Sturmia* or the subfamily Danainae have been associated as primary and secondary hosts of this genus. Hirai & Ishi (1995) recorded *T. fasciata* (Strand) (previously *Poecilogonalos fasciata*) as hyperparasitising *Sturmia bella* (Meigen), a parasite of *Parantia sita* (Moore) (the tiger chestnut butterfly), in Japan.

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